



The Transition to the Cloud – A Midlife Checkup

WHITE PAPER

The Transition to the Cloud

A Midlife Checkup

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Key Takeaways

■ A full 20 years into the cloud transition, the transition of storing data and running calculations on companies' own servers to a model of renting centralized IT-infrastructure, the cloud market's structure has fallen into place. In this paper, we attempt to show how one can connect the large market caps of the "hyperscale" vendors to their large addressable market, superior growth, dominant market shares and high margins. An acceleration in revenue growth, partly due to the Covid pandemic fueling the digital economy, and strong share price performances of our holdings in Amazon, Microsoft and Alphabet, merited a deeper look at the state of the cloud market. After conducting interviews with analysts, CTOs and consultants, our view is that market participants could be underestimating the total addressable market, and by implication the sustainability of growth of the cloud providers. The upside to estimates is driven both by future technologies such as IoT and autonomous cars, but also by the old legacy systems starting to move to the cloud – all at a time when the risks, while increasing, look manageable.

When a small group of Amazon executives gathered in Jeff Bezos' house in 2003 to brainstorm about the

firm's core competencies, it is hard to imagine that they expected the exercise would turn into launching a transformation of the whole IT-industry and the largest infrastructure project ever undertaken. A couple of years earlier, Amazon had struggled with inefficiencies in its software development process leading to delays in the development of its Merchant.com third party software platform. This problem was not resolved until the company started sharing a set of application programming interfaces (APIs) among its teams. The key conclusion from the brainstorming session was that the company was now – three years later – highly adept at quickly and efficiently developing software using a set of common tools. Perhaps that ability could be scaled and sold outside of the firm? In 2006, Amazon Elastic Compute Cloud, the predecessor to what we now know as Amazon Web Services (AWS), was launched and the rest as we say is history.



In 2006 Amazon Elastic Compute Cloud, the predecessor to Amazon Web Services, was launched and the rest is history.

Part of that initial name stuck and today the services we now call "Cloud Services" has become a USD 370 billion market and is quickly disrupting the traditional way of running software, on local, "on-premise" servers. The cloud market can broadly be divided into the smaller USD 70 billion private cloud market where a firm hires dedicated resources not shared with any other firm

to compute and store its data and the USD 300 billion public cloud market. In a public cloud, the service is delivered over the Internet and more importantly different firms share resources, often running software on the same server, but in separate “instances”. This makes it a highly scalable business and is the core focus for the three cloud giants Amazon, Microsoft and Alphabet, commonly referred to as “hyperscale vendors”, given their now massive operations. The public cloud can be further divided into Software-as-a-Service (SaaS), a fragmented market where pioneers such as Salesforce.com and Adobe delivers the whole stack to the end customers, all the way from hardware to the SaaS-providers own end-user software. The SaaS provider can either own the whole stack or buy hardware and network services from for instance a hyperscale vendor. What Amazon launched was Infrastructure-as-a-Service (IaaS), a more bare-bones approach where networking and servers are combined with the software feature of running different companies’ data on shared hardware. This then lets the end customer build its own software on top of this infrastructure. Somewhere in between these two approaches we now see Microsoft dominating the Platform-as-a-Service (PaaS), where even more software is provided by the hyperscale vendor, such as an operating system, for the end customer to run its own applications on.



The SaaS provider can either own the whole stack or buy hardware and network services from for instance a hyperscale vendor.

So why now, 20 years into this shift to the cloud, does this merit a revisit of the trend? Firstly, as portfolio managers, we constantly need to re-visit our assumptions to gauge whether our investments still look like attractive long-term holdings, especially after the momentous rise these shares have seen over the last couple of years. Secondly, it is only in recent years, as

both Microsoft and Alphabet have been accelerating investments into the cloud for only the past five or six years, that market share data, business models and margins seems to be crystalizing. Finally, after the Covid-outbreak, an acceleration in sales has been seen for all the major cloud vendors and we need to understand whether this is a temporary phenomenon or if this is a structural shift in growth rates. To update us on where we stand on this trend we conducted a number of interviews with industry experts, analysts, consultants and Chief Information Officers responsible for the transition of their software to the cloud to try to model our own assumptions of the durability of the transition to the cloud.

Connecting the cloud market and cloud firms’ strengths to their market caps

One useful tool in trying to understand the competitive moats which companies exhibit, the internal benefits that accrue from them and the barriers to entry that they pose for competitors is the “7-Powers framework”. This approach was outlined by former consultant and now portfolio manager Hamilton Helmer in his book “7 Powers – The foundations of business strategy” ¹⁾. While a full discourse of this book merits its own white paper, we will use it as a broad guide for showing why the multi-trillion-dollar market caps that the hyperscale vendors exhibit seems sensible. In the book, Hamilton derives the following equation:

$$NPV = M_0 g \bar{s} \bar{m}$$

M_0 \equiv current market size

g \equiv discounted market growth factor

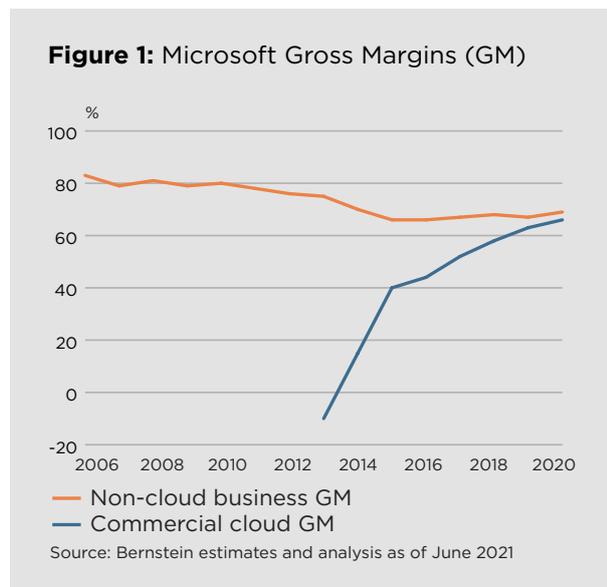
\bar{s} \equiv long-term market share

\bar{m} \equiv long-term differential margin
(net profit margin in excess of that needed to cover the cost of capital)

1) 7-Powers - The Foundation of business strategy, Hamilton Helmer, Oct 2016

The book only concerns itself with explaining the seven “powers” and their influence on the last two variables, market share and margins, but to fully understand the net present value, or simply market capitalization of a company, an analysis of the market size and growth is needed.

Let us look at the last two components first, starting with margins. As all the three large hyperscale vendors are reluctant to disclose margin data for their cloud businesses and in the case of Alphabet, which only recently started to disclose sales numbers, we have to rely on estimates. The three cloud vendors are trying to “climb-up-the-stack” and provide more software content, with higher margins, resulting in stickier customer relationships. Hence using Microsoft, with its more software heavy PaaS as a gauge of where margins might end up seems sensible. Clearly, the picture that emerges is that after several years of accelerating investments the margin leverage is starting to come through as gross margins for the cloud business are now at the same level as the non-cloud-business (see figure 1). Amazon’s operating margin for AWS is estimated at around 30%, about the same margin that all of Alphabet exhibits, pointing to a large margin upside for Alphabet as its cloud business is still loss making.



Over the last five years, Microsoft has emerged as the leader in PaaS, with estimates pointing towards holding more than a quarter of the market and having widened the gap over AWS from five years ago. Amazon remains by far the dominant vendor of IaaS, well ahead of Microsoft and Alphabet, the latter being a distant third vendor in both sub-markets of the western vendors – see figure 2 on the next page.

In the light of the 7-Powers framework what enables these firms to have high and rapidly rising margins and dominant market shares? Out of the seven powers two stand out. In our interviews with industry experts, we were somewhat surprised that the “stickiness” of on-premise software also seems to hold in a cloud setting. Once a dominant market share position is established, high “switching costs” remains a key reason why software firms often tend to hold this position for a prolonged period of time. By increasing the integration into the cloud vendors’ specific software tools, the end-customers get locked-in. The standout power that these firms exhibit is clearly “scale”, the infrastructure that the leading firms have built is unsurpassed and might classify as the largest infrastructure project ever attempted.



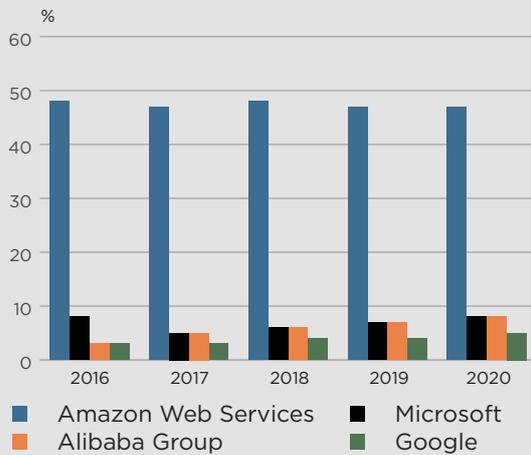
The cost per square meter for constructing data centers is the same as the cost for constructing a skyscraper, but revenue per square meter is five times as high.

According to Mark Mills, the author of “The Cloud Revolution”, the current number of enterprise data centers in the world is 5000²⁾. This is in contrast to the 1500 skyscrapers built. The cost per square meter for constructing data centers is the same as the cost for constructing a skyscraper. What stands out in this comparison is the revenue potential – a data center brings in five times more revenue per square meter than

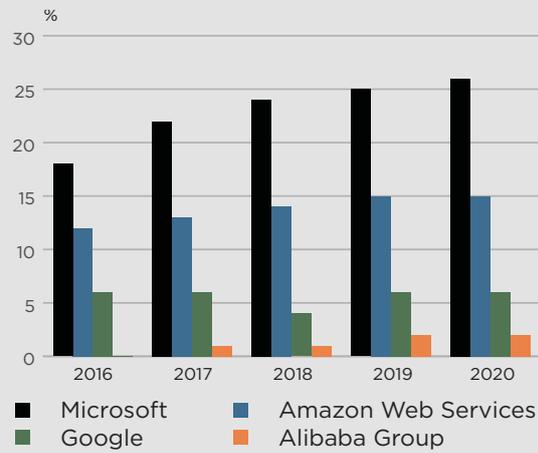
2) *The Cloud Revolution – How the Convergence of new Technologies will unleash the next economic boom and a roaring 2020s*, Nov 2nd 2021, Mark P Mills.

Figure 2:

IaaS is dominated by first mover Amazon



... whereas Microsoft leads in PaaS



Source: Bernstein analysis as of August 2021

a skyscraper. The number of hyperscale data centers, the ones built by the hyperscale vendors to supply cloud services, is around 650. Imagine looking at a picture of Manhattan and realizing that a select few firms owned more than 10% of all skyscrapers? The ability to have large and local data centers is crucially important in many industries. UBS, the largest bank in Microsoft's Azure cloud, clearly stated that a key reason Microsoft was chosen was the ability to have two data centers in Switzerland instead of just one, as which could only be offered by other competitors.

The scale of the buildout does not stop with the data centers. In order to connect the data centers across

continents one needs subsea cables. According to the "The 2021 Submarine cable map"³⁾, there exists 464 submarine data cable systems. One of the key trends is that these cables now, unlike in previous investment booms, are increasingly owned and operated by hyperscale vendors such as Amazon, Microsoft and Google. On some routes such as over the Atlantic, intra-Asia and trans-Pacific, the hyperscale vendors makes up around 50% of the demand for data capacity. Alphabet alone is part or sole owner of 20 of these cables and operates the fastest data cable in the world⁴⁾, the 350 terabit per second cable named after programming pioneer and Rear Admiral, Grace Hopper.

3) <https://submarine-cable-map-2021.telegeography.com/>

4) <https://blog.telegeography.com/telegeographys-content-providers-submarine-cable-holdings-list>

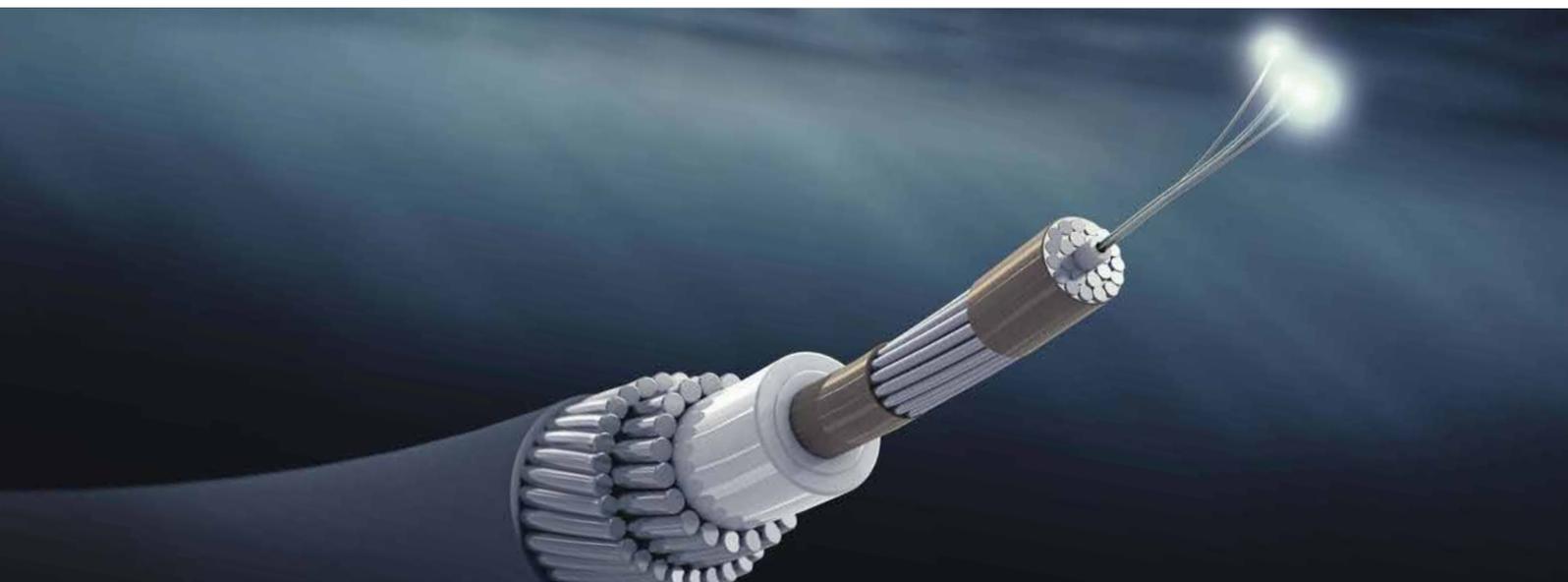
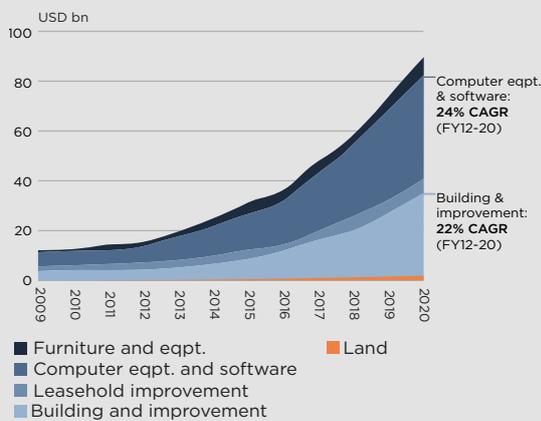


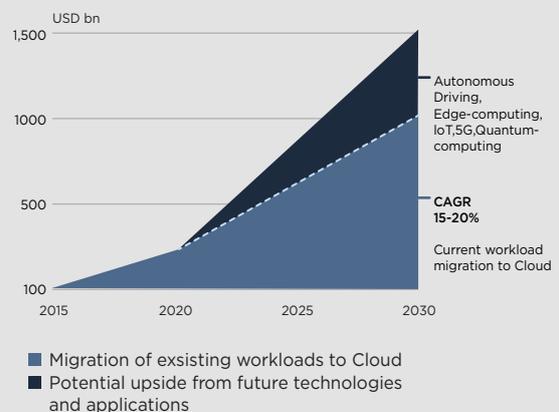


Figure 3: Microsoft – property & equipment (gross)



Source: Bernstein analysis as of June 2021

Figure 4: Cloud TAM opportunity



Source: CWW Estimates as of October 2019.

While Microsoft lags behind with only three partly owned cables the acceleration of the cloud buildout that started in 2015 is clearly visible on its balance sheet which is now approaching USD 100 billion in gross Property & Equipment, driven by computer equipment, software and buildings – see figure 3.

Moving on to the first part of the equation, market size and growth, a good starting point is the assumptions we made in 2019 in our white paper [Cloud Computing at an Inflection Point](#) about these two variables as shown in figure 4. This was, of course, ahead of us knowing that Covid would help accelerate the transition to the cloud.

Covid acting as an accelerator of growth

Back then we expected the cloud market to be a USD 1.5 trillion market by 2030 driven by the current workloads transitioning from on-premise to the cloud and with new applications such as Internet-of-Things, 5G and autonomous driving making up around a third of the market. As we entered the 2020s, our assumption was that an acceleration in growth would start to be driven by an increased acceptance from corporates in transitioning existing workloads to the cloud and by new technologies (depicted in dark blue in figure 4) to help fuel growth. As we all now know, Covid struck in late 2019, and the whole world had to turn to work-from-home with the consequent massive shift to e-commerce in a matter of months.

The experts we talk to highlight the fact that Covid and the cloud-based collaboration tools that we now use greatly helped with corporate acceptance for moving more advanced systems and data to the cloud.

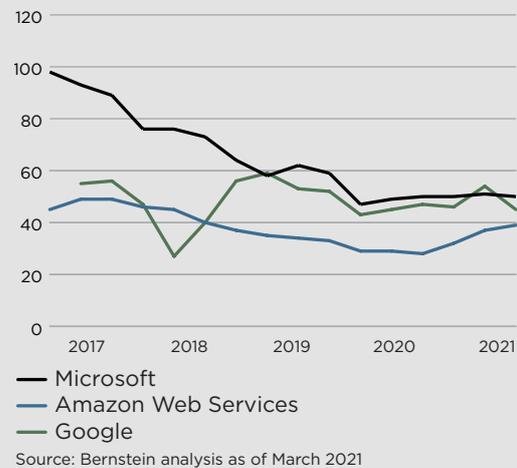
//
**No piece of data
is too secure not to be
on a public cloud 5)**

*Steven Jeffrey,
Head of Cloud Business Office, UBS*

With the Covid pandemic acting as an enabler, and with companies having two years to rethink their cloud strategy, we can now see that the trend of very high but slowing growth has been reversed as growth rates for the hyperscale vendors are now either flat, at high levels or even accelerating.

This leaves us with the final part of the equation, market size. While the current market size at around USD 350-

Figure 5: Cloud revenue growth



370 billion is large, the Total Addressable Market (TAM), is enormous. The prevailing method for calculating the cloud TAM seems to be to take current global IT spending of around USD 1.6-1.9 trillion and assume a percent of that spending migrates to the cloud. This can, for example, be compared to the global spending on energy investments of USD 1.9 trillion according to IEA⁶⁾. A common estimate of how much of software spending that ultimately will transition is around 70% leaving us with a TAM of around the USD 1.5 trillion we assumed two years ago. Mark Moerdler, an analyst at Bernstein, and one of the leading thinkers on the cloud market, further assumes a multiplier effect as new capabilities are used in the cloud taking us to estimates closer to USD 1.9 trillion⁷⁾. Signs are now emerging that this approach could even be underestimating the TAM.

Several reasons to be optimistic on the actual Total Addressable Market's size

During its 2021 first quarter earnings call Microsoft's CEO Nadella pointed out that IT spending as a percentage of GDP should move from 5% to 10% of GDP by 2030⁸⁾. IT spending growth is now in the mid single digits, and should this occur assuming GDP growth of a couple of

5) UBS, Tech Conference call, 2021-10-05

6) <https://www.iea.org/reports/world-energy-investment-2021/executive-summary>

7) *Cloudification of Tech: The sky's the limit*, April 2021, Alliance Bernstein.

8) Microsoft Q1 2021 Earnings call, 2021-10-27, Satya Nadella Microsoft's CEO



percentage points, IT spending growth would accelerate to close to 10%. Sell side analysts admit that this would mean upside to estimates for cloud growth, but it is not yet in their numbers. This would raise the estimate for the light blue area in figure 4, or the “base-spending” on IT. The CEO of a cloud consulting firm points out that as 75%-90% of applications will be built directly in the cloud by 2025, and as companies then get access to the latest artificial intelligence (AI) and machine learning (ML) tools, growth will accelerate further⁹⁾. While new applications such as IoT, 5G and self-driving cars driven by AI and ML, likely underpins some of the assumptions that Microsoft expects to accelerate growth, this could potentially add further upside to cloud TAM estimates. Furthermore, a type of spending that does not seem to be fully captured by IT spending is the very old code bases that exist in corporations that need to be transferred, but where only some maintenance spending is being done and where the programmers supporting these systems are also now retiring. When we talked to the founder of a software automation firm, he illustrated this dilemma with the example of a major U.S. bank where the credit card system was written in the late 1950s and currently maintained by two programmers, the youngest of the two being 75 years old. According to his assumptions there are approximately 2 trillion lines of code in legacy systems, and due to the increasing difficulty of maintaining it as well as new security demands, this code needs to be moved to the cloud¹⁰⁾.



Only about 3% of legacy mainframe workloads have transitioned to the cloud.

The complexity and cost of moving the code has meant that companies such as banks have been reluctant to make the transition and so far, only about 3% of these mainframe systems have moved to the cloud, compared to around 20% of overall workloads having been moved. The problem with moving code this old is that there is a need for refactoring or “cleaning” the code to move it. Refactoring code is expensive, and estimates vary

9) Phone Interview, 2021-09-20

10) Phone Interview, 2021-10-04

between 1-15 USD per line of code. If the 2 trillion lines of code is close to being true, and even when calculating that some of it might simply be scrapped, this third wave of cloud transition could add hundreds of millions of dollars to the TAM, if not more.



The third wave of the cloud transition could add hundreds of millions of dollars to the TAM.

Taking these factors together, a possible acceleration in core IT spending, acceleration in new technologies being built “natively” in the cloud and old code bases that need to be moved, there is substantial upside to market estimates of cloud TAM and market growth.

Risks are increasing but looks manageable

The primary risks to the cloud transition in the medium term are a major data leak or breach at one of the main cloud providers and political interference, especially from European politicians wary of U.S. dominance in this field. An often-overlooked risk is the energy needs of the cloud transition as the energy consumption per square meter of an enterprise data center is 100x that of a skyscraper per square meter in combination with data growth that we have constantly underestimated in the past.

The first risk seems the simplest to address; there simply is no alternative that is safer. The hyperscale vendors have resources to fend off attacks from state actors that their end users simply cannot afford or manage on their own. Two examples of the acceptance of the cloud as ultimately being the safest option are the multi-billion-dollar cloud deals the CIA struck with Amazon in 2013 and multiple cloud vendors in 2020 and the fact that large banks are now moving core banking systems to the cloud. Political interference is more difficult to estimate but given that the cloud transition so far has been less visible than for instance the e-commerce side of Amazon

or Google’s core search, a tougher stance still seems a couple of years away. The massive investments backing a European incumbent should deter sensible politicians from attempting to interfere. If Alphabet itself is deemed subscale in Switzerland having only one hyperscale data center, what will an upstart be?

In many other markets the risk of Chinese competition is constantly present. Here the risk outside of China is minimal as no one in the west would trust their data to a Chinese cloud, ultimately controlled by the Chinese Communist Party. The market outside of China is also so immense that there is no need for the western cloud providers to enter the Chinese market.



The main risk is data breaches, but there simply is no credible alternative to the cloud

The enormous energy consumption is sometimes brought up as a risk as cloud investments grow, but we would argue that there are two credible pushbacks. Firstly, the hyperscale vendors are able to guarantee long-term demand for renewable energy helping fund the transition to renewable energy sources. This is currently led by Alphabet which now fully uses renewable energy sources for its cloud services. Secondly, digitalization is turning physical goods, let us say a DVD, into something we now stream, removing the need for producing, shipping and storing a physical item, in itself a net benefit for the environment. Perhaps an underestimated risk in the long term is the amount of data that we as human beings generate will be so large that it simply cannot be stored anywhere, no matter how energy efficient we run our cloud. Should that eventually occur, the hyperscale cloud providers will likely have been enjoying several years of outsized growth before we reach that point.

To sum up, it looks to us that there is material upside to the size of the addressable market and by implication also to the share prices of the cloud giants, while any credible threats, still seem many years away.



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